

FIG. 1 (PRIOR ART)

100

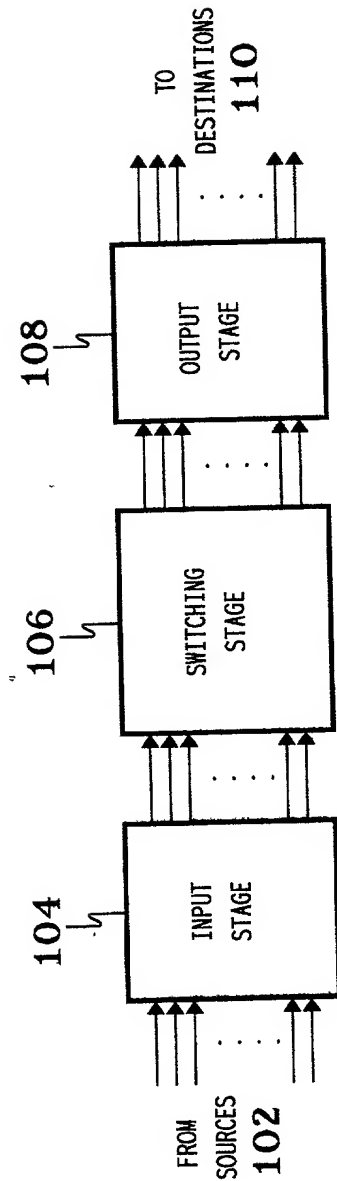


FIG. 2

200

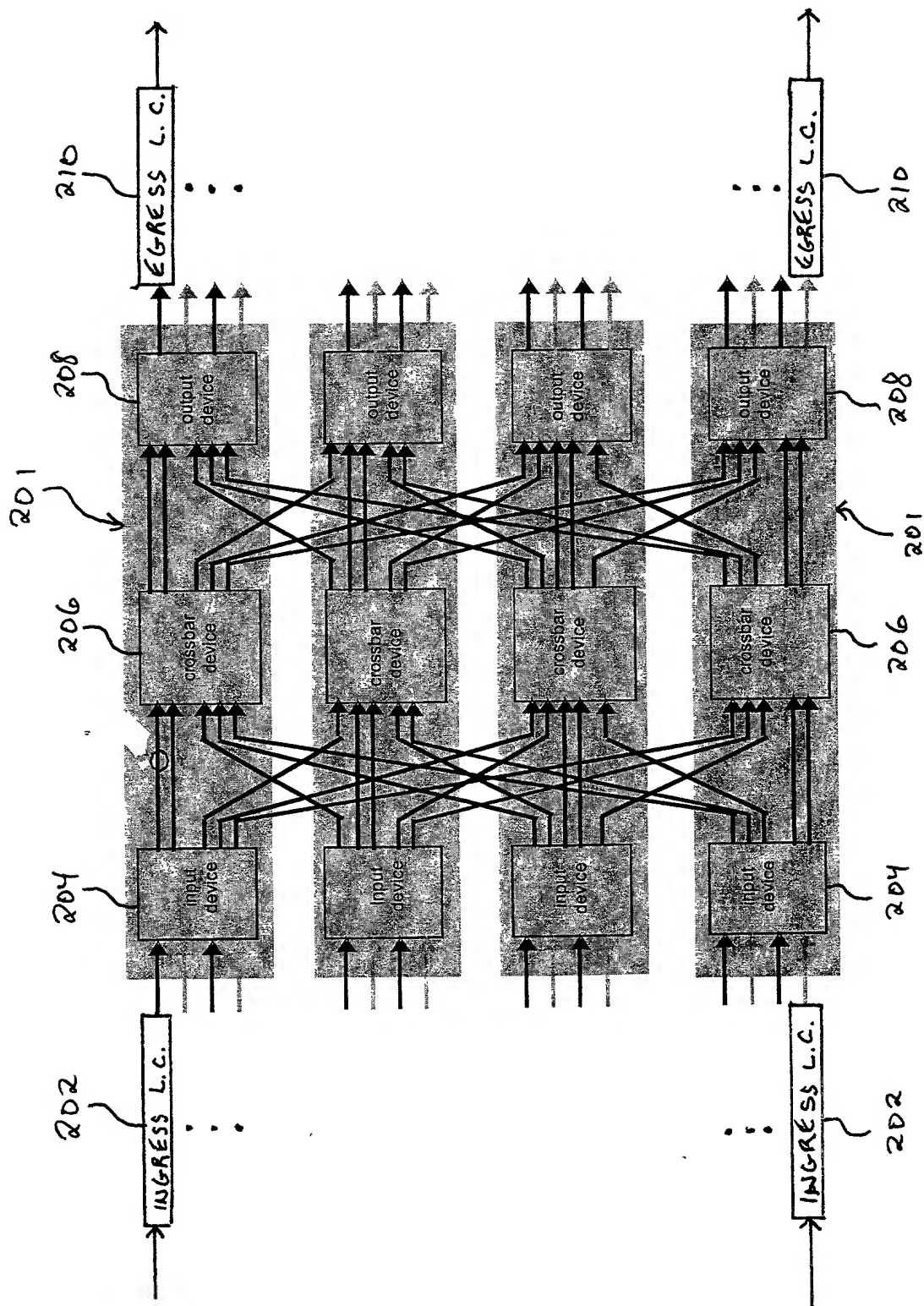


FIG. 3

300

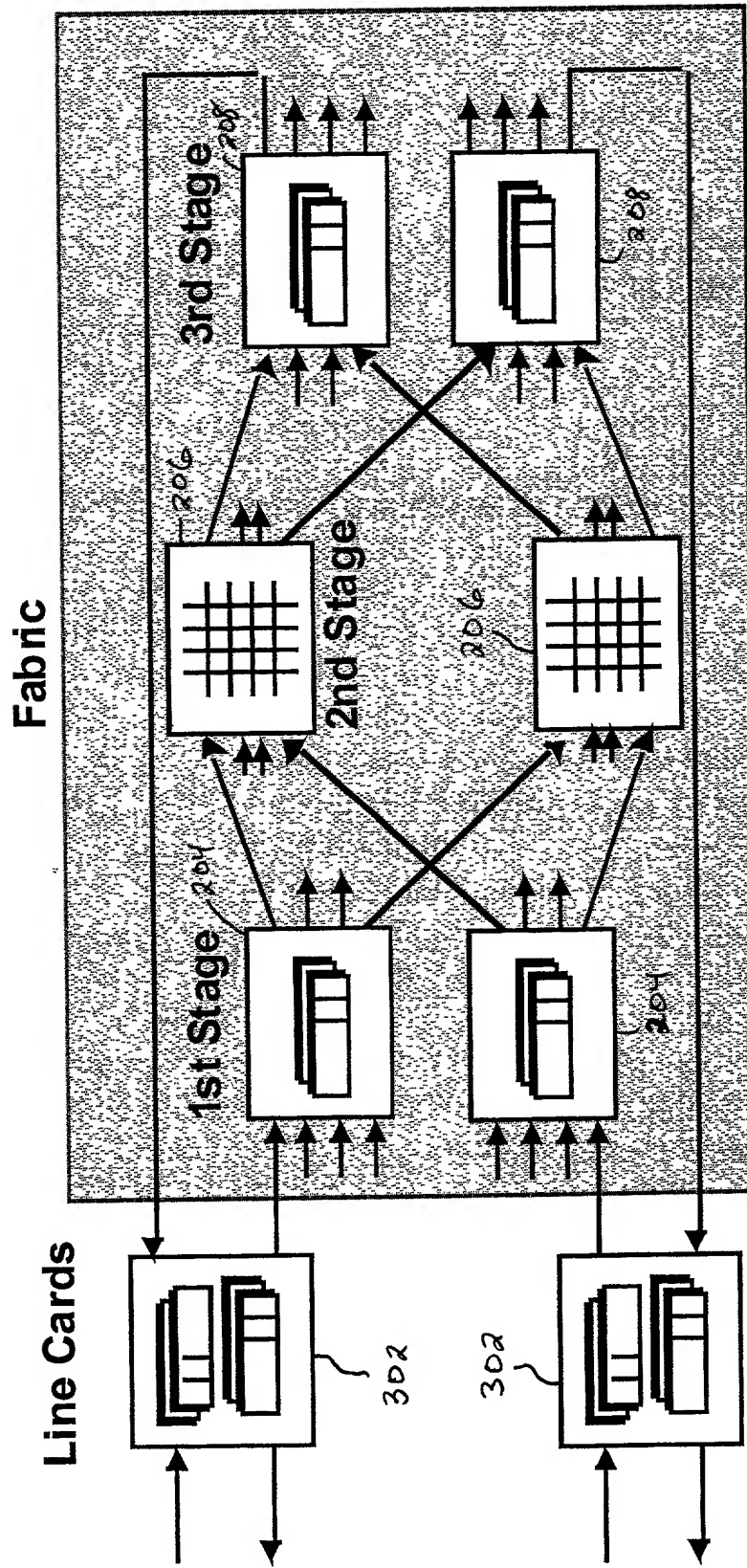


FIG. 4

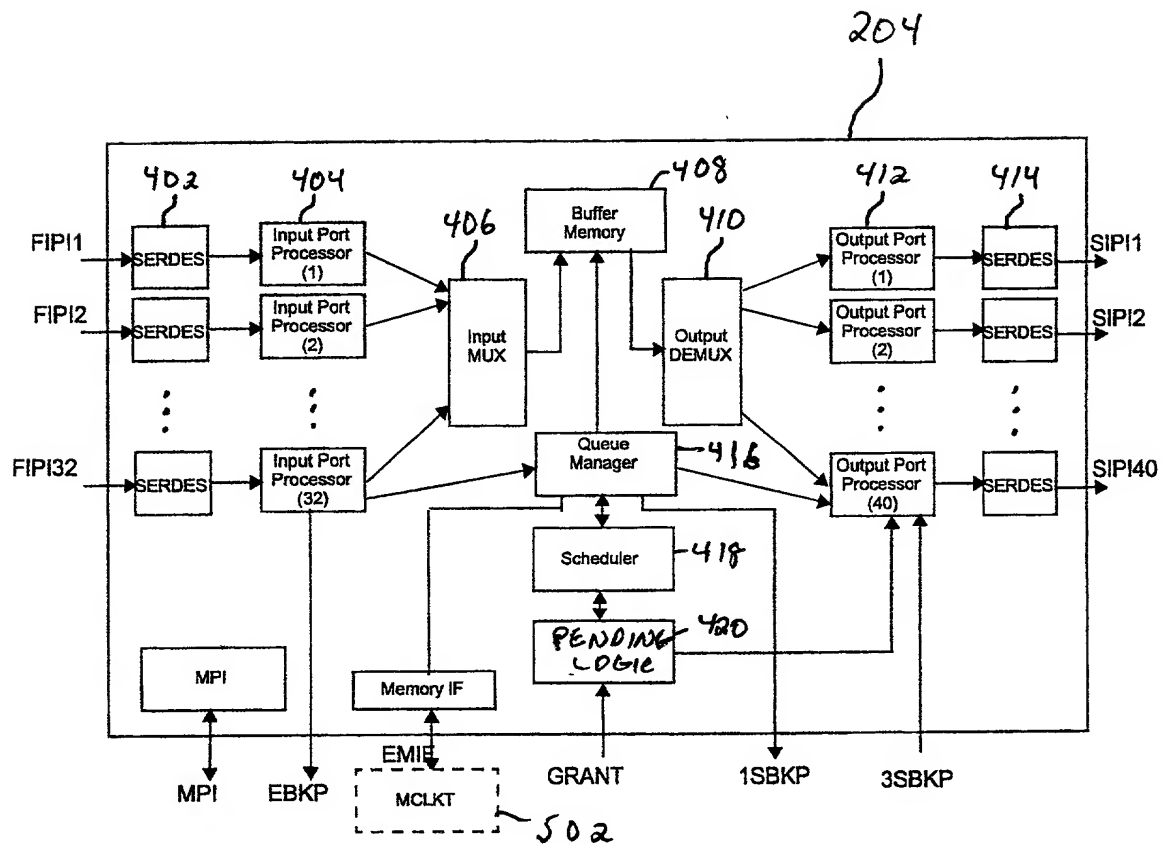


FIG. 5

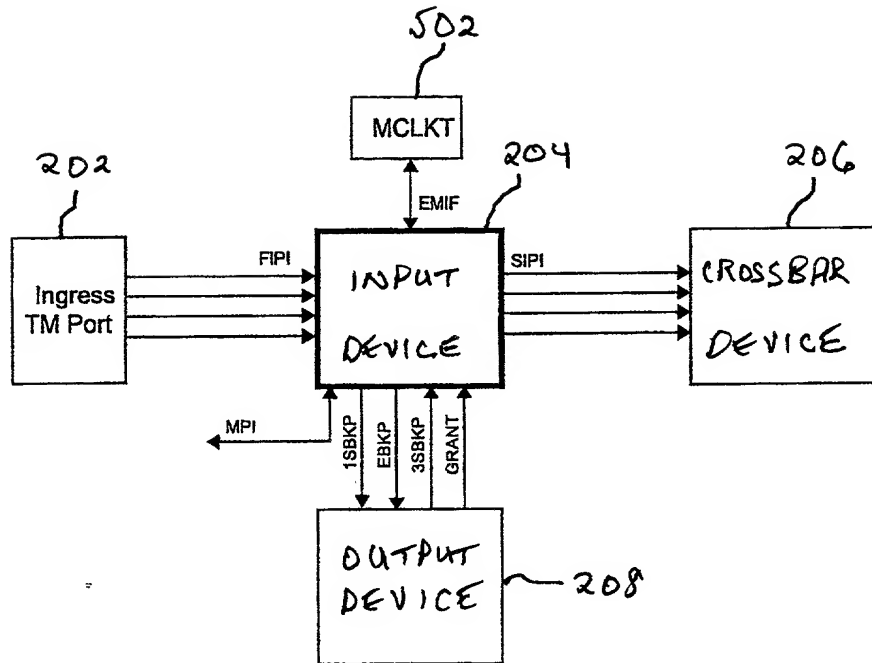


FIG. 6

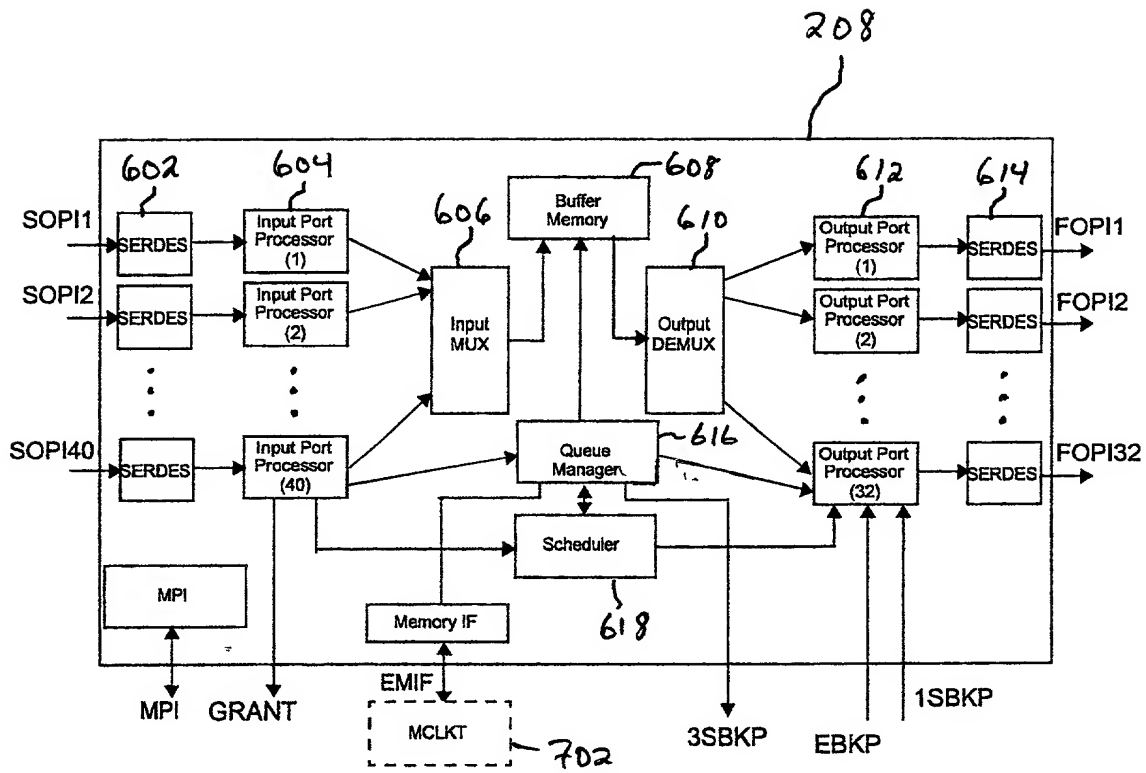


FIG. 7

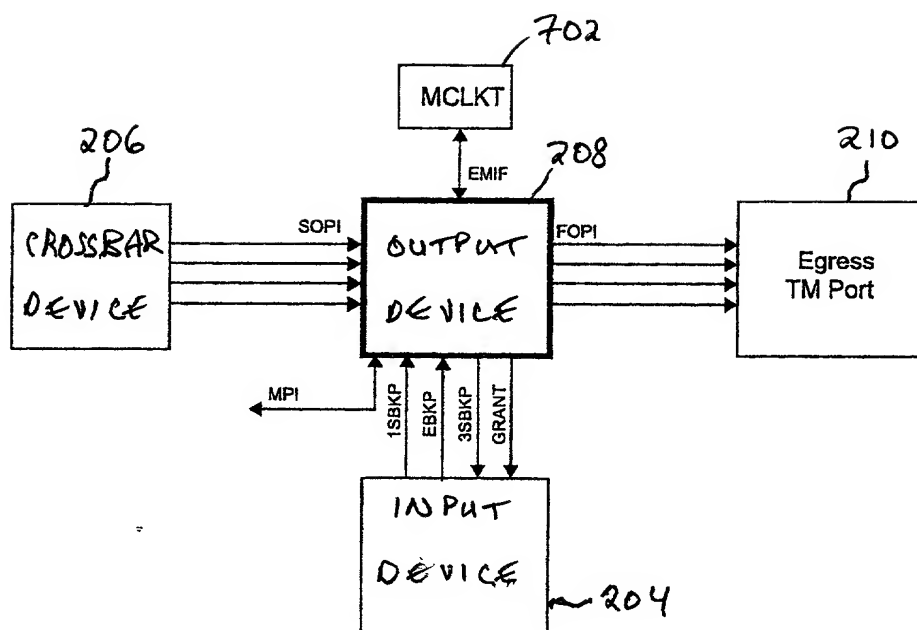


FIG. 8

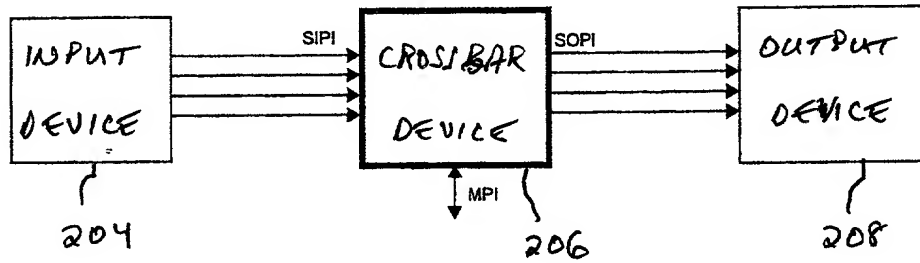
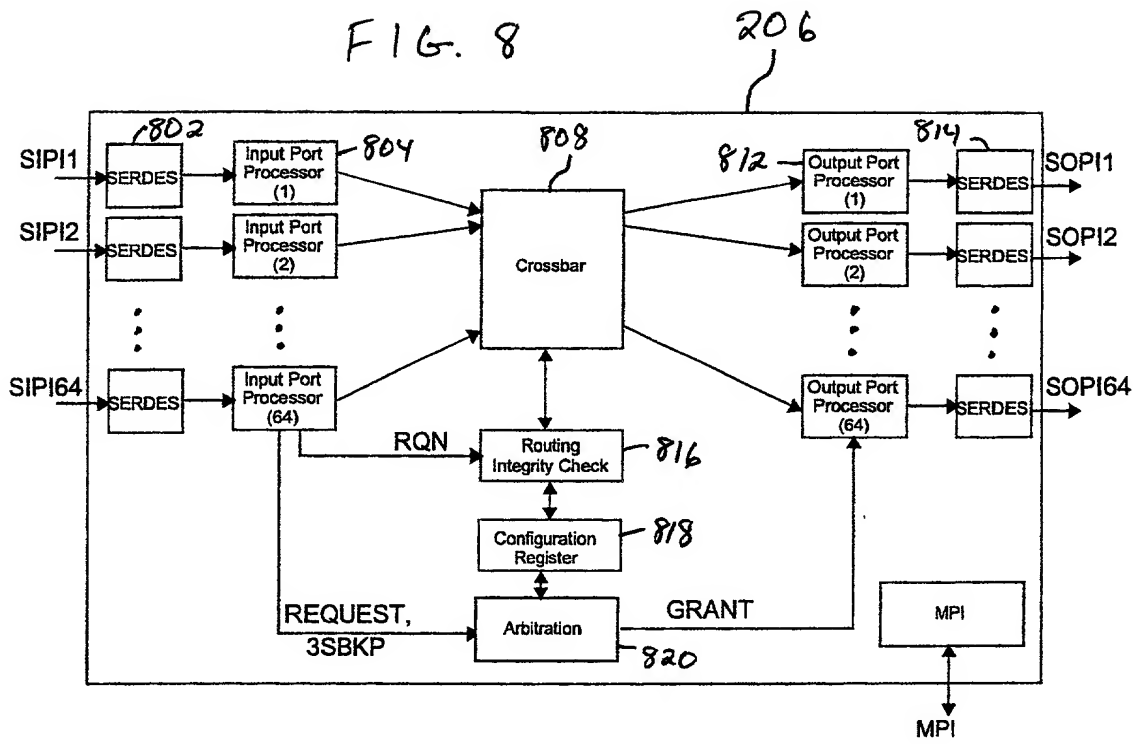


FIG. 9

FIG. 10

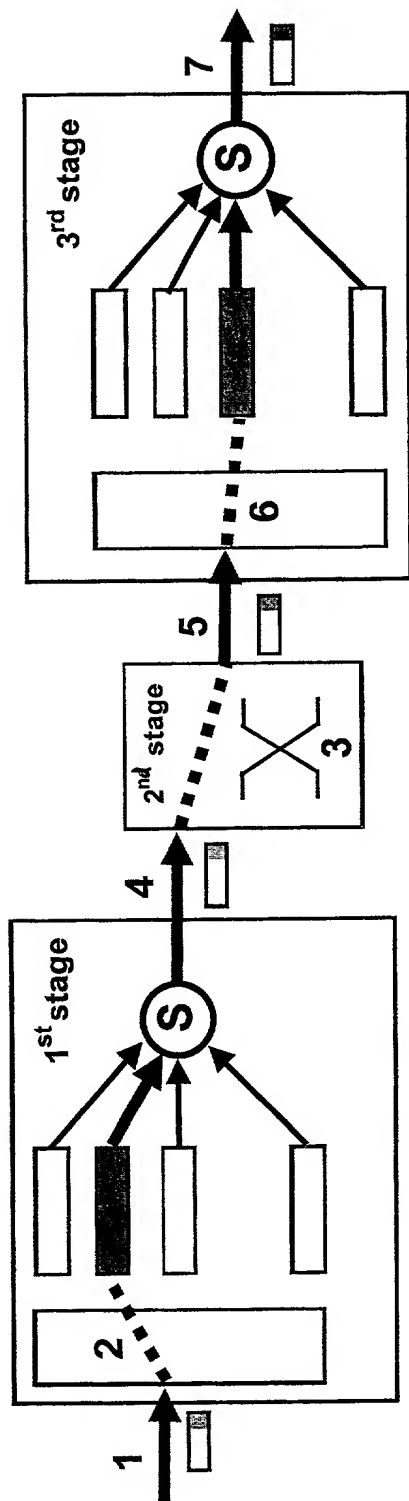


FIG. 11

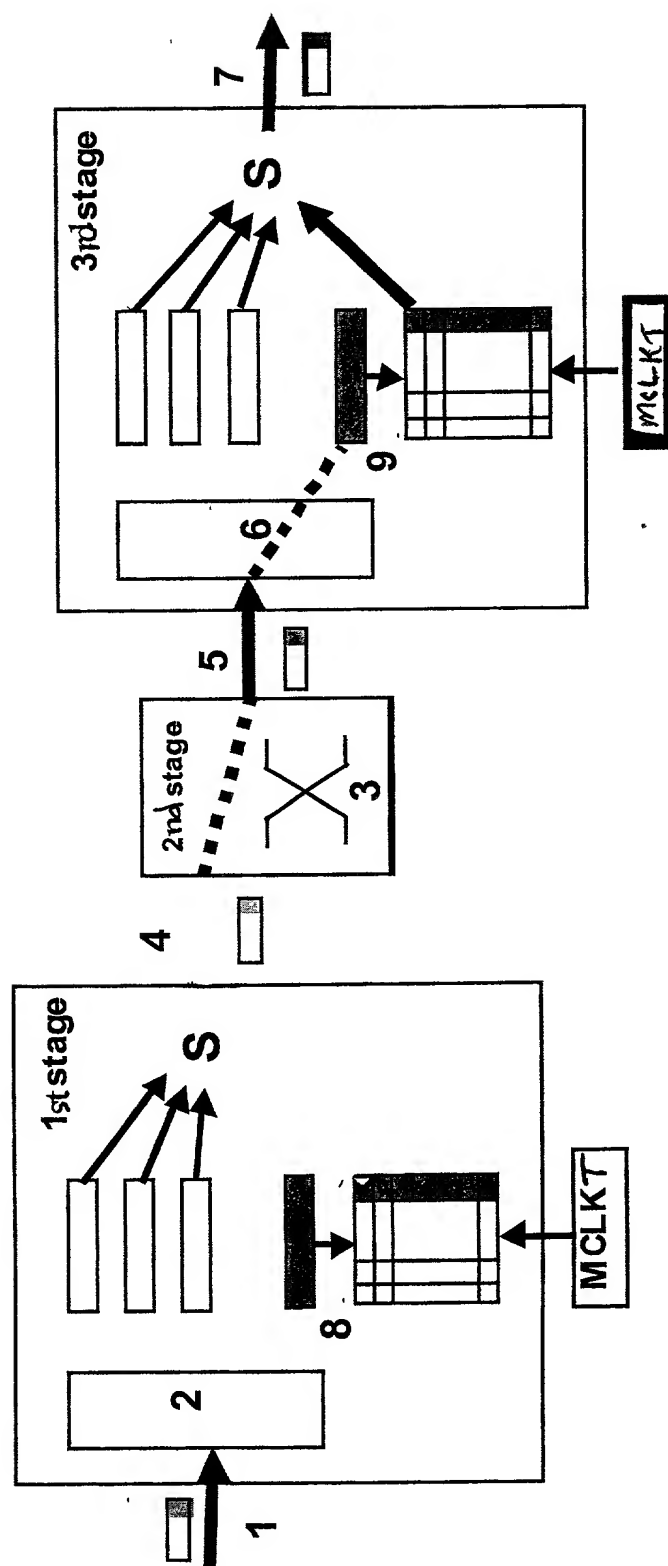


FIG. 12

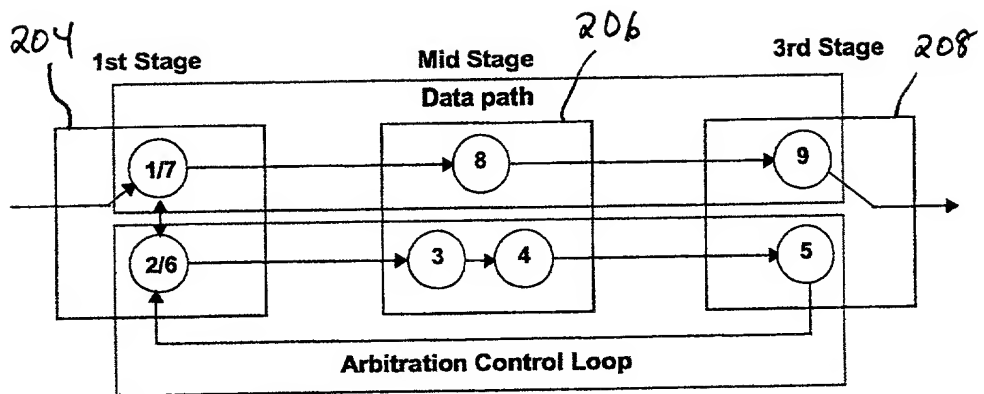


FIG. 13

IDLEBID(1)	BIDCH(2)	RDESTD(6)	RDESTP(5)	R3QN(10)	RSRCD(6)
------------	----------	-----------	-----------	----------	----------

Data	Size	Description
IDLEBID	1	Idle bid indicator. It is extracted from cell header (BIDTYPE field). 0 - idle bid 1 - valid bid
BIDCH	2	Bid Channel. It is extracted from cell header (BIDTYPE field). 0 - Unicast GBW channel 1 - Unicast BE channel 2 - Multicast GBW channel 3 - Multicast BE channel
R3QN	10	Requested 3rd Stage Queue Number. It is extracted from cell header (REQRQN field).
RDESTD	6	Requested 3rd Stage Device. It identifies a 3rd stage device. It is extracted from cell header (REQDEST field)
RDESTP	5	Requested 3rd stage Port. It identifies an egress port number of a 3rd stage device. It is extracted from cell header (REQDEST field)
RSRCD	6	Requesting 1st Stage Device. It identifies a 1st stage device that generates the request. It is derived from the input link number.

FIG. 14

FIG. 15

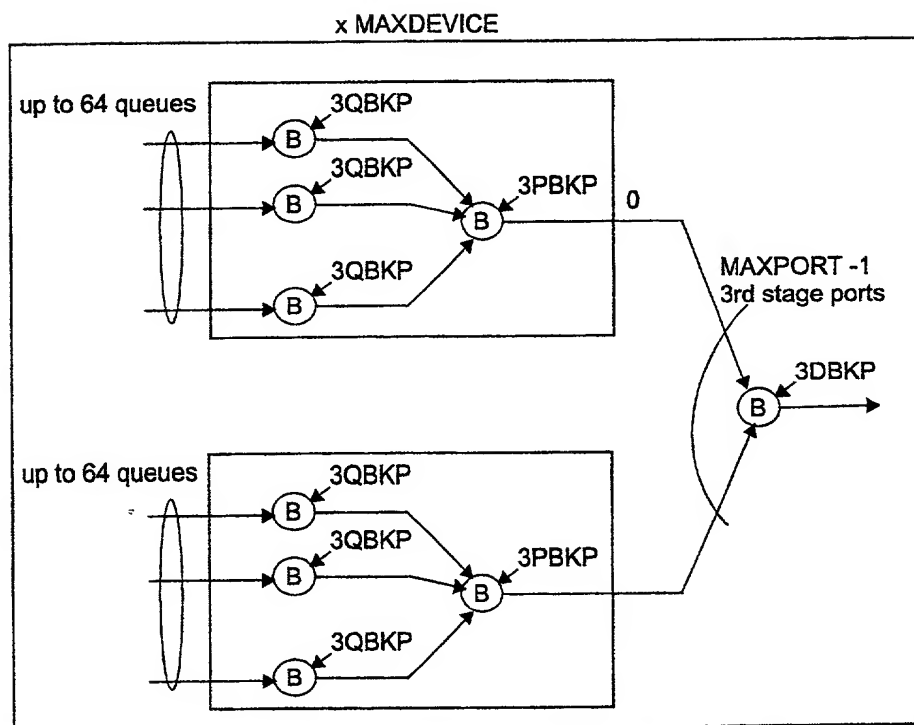


FIG. 16

3PBKPSBT

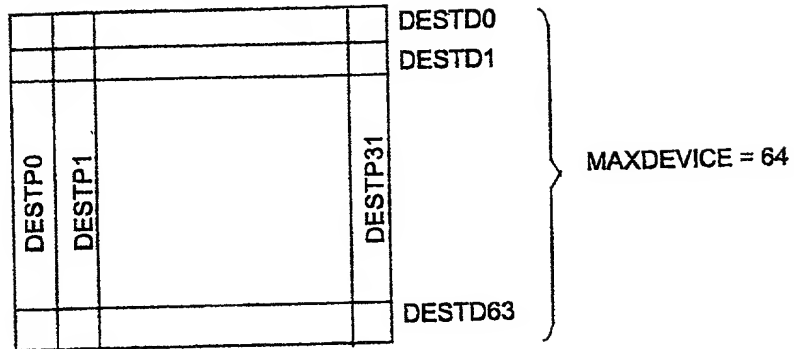
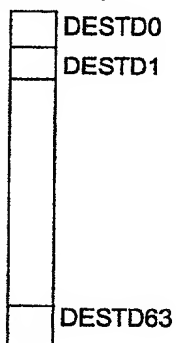


FIG. 17

MCBKPSBT

High Priority



Low Priority

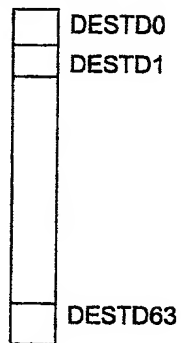
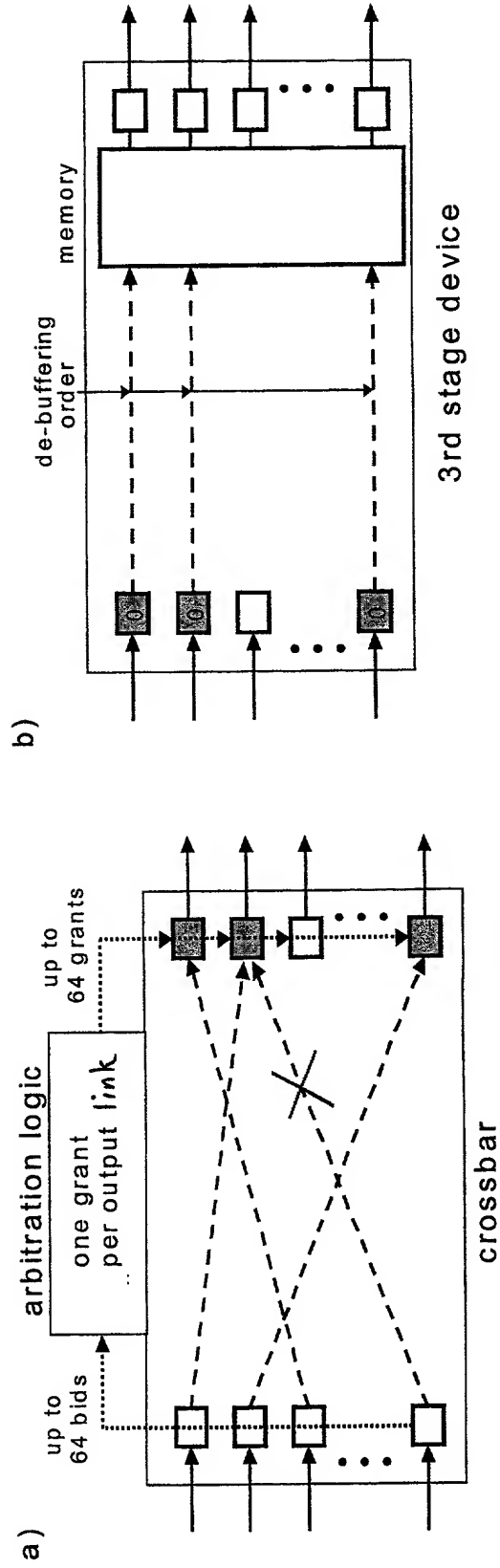


FIG. 18



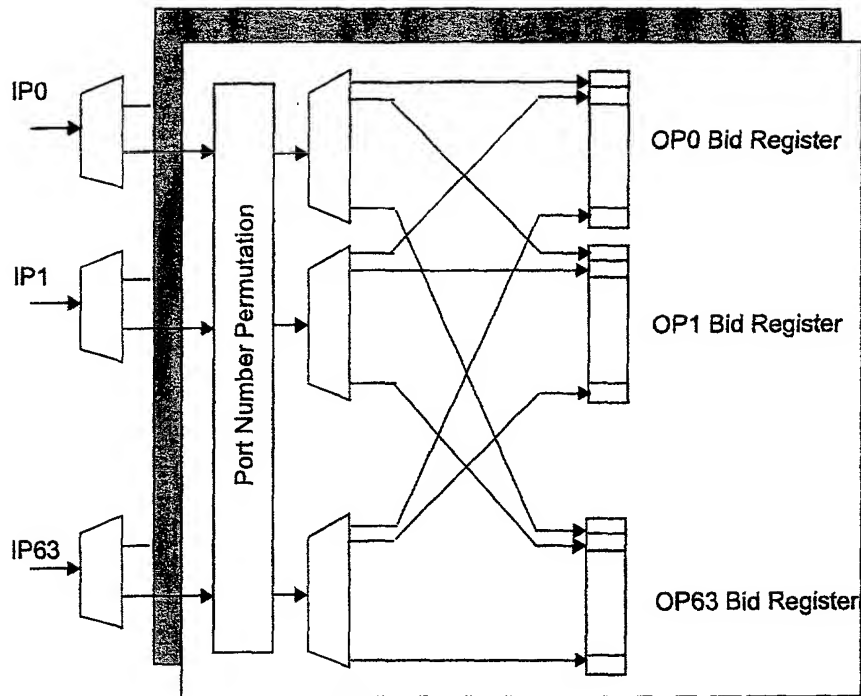


FIG. 19

GRANT(2)	GNTDEST(10)	GNTRQN(10)
----------	-------------	------------

FIG. 20

FIG. 21

```
For each crossbar device,
  For each time slot,
    Deny all bids to back-pressured ports or queues,
    Deny all low-priority bids to output devices when higher priority bids are present,
    For the remaining bids,
      For each output device,
        Randomly select one of any contending bids for grant

For each input device,
  For each time slot,
    For each crossbar device,
      If the bid submitted L slots earlier was granted,
        Transmit cell to the output device using the crossbar device
      Else
        If the bid was denied due to collision,
          Bid again to the crossbar device for the same output device
        Else
          Bid to the crossbar device for the next output device in pre-configured sequence (crossbar)
```

FIG. 22

Initialization:

Set window $\geq \#$ of links * latency;
Credit = window

Scheduler:

Where there is a backlog and credit > 0 ,
Schedule a cell from VoQ;
Decrement credit

Pending Logic:

For each time slot,
For each received grant signal from each crossbar device,
Transmit a cell;
Increment credit;
Submit bids up to # of links from the pending queues

FIG. 23

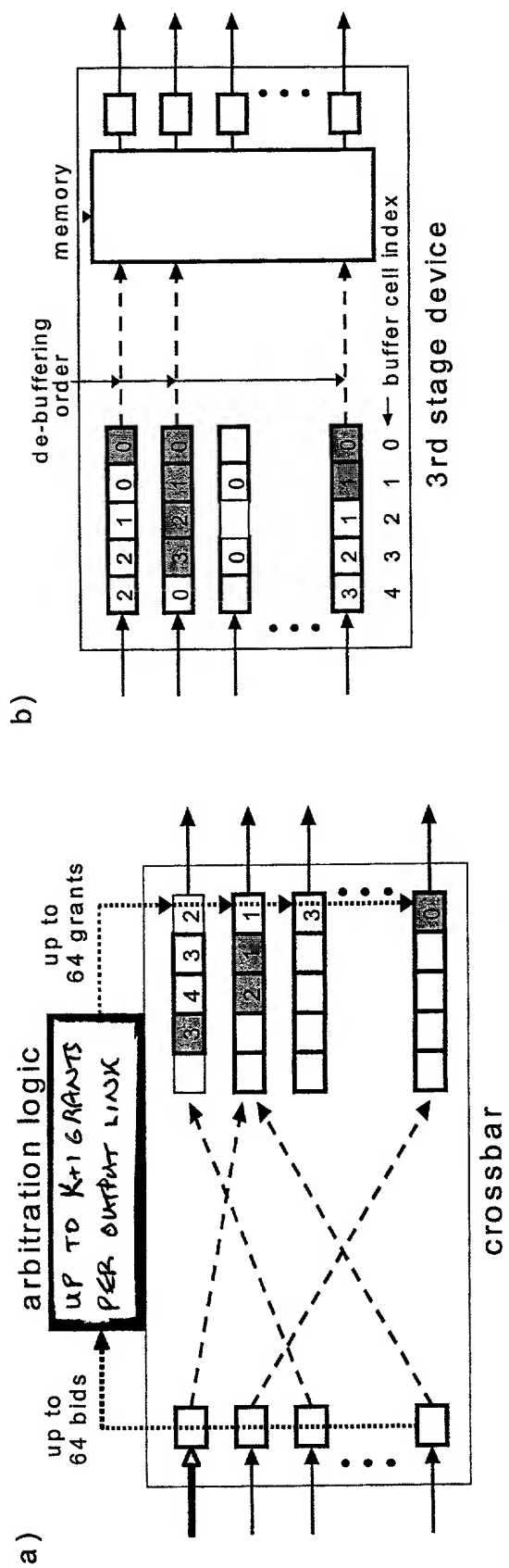


FIG. 24

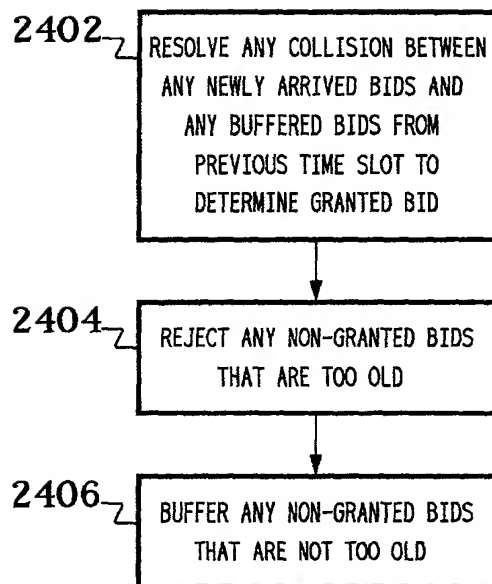


FIG. 25

TABLE I
PERFORMANCE IMPROVEMENTS WITH BUFFERS AT THE CROSSBAR

K	Throu- ghput [%]	Max 3 grants	Max 2 grants	Gain [%]	Max 3 grants	Max 2 grants
0	63.5			0.0		
1	78.8			24.1		
2	84.9		83.62	33.7		31.68
3	88.5	88.39	86.18	39.4	39.20	36.69
4	90.8	90.70	87.37	43.0	42.83	37.59
5	92.2	91.64	88.14	45.2	44.34	38.80
6	93.2	92.66	88.82	46.8	45.92	39.87
7	93.9	93.55	88.96	47.9	47.32	40.09
8	94.7	93.98	89.37	49.1	48.00	40.74
9	95.3	94.40	89.66	50.1	48.66	41.20
10	95.7	94.90	89.57	50.7	49.45	41.01
15	97			52.8		
20	98			54.3		
30	99	97	90	55.9	52.76	41.85

FIG. 26

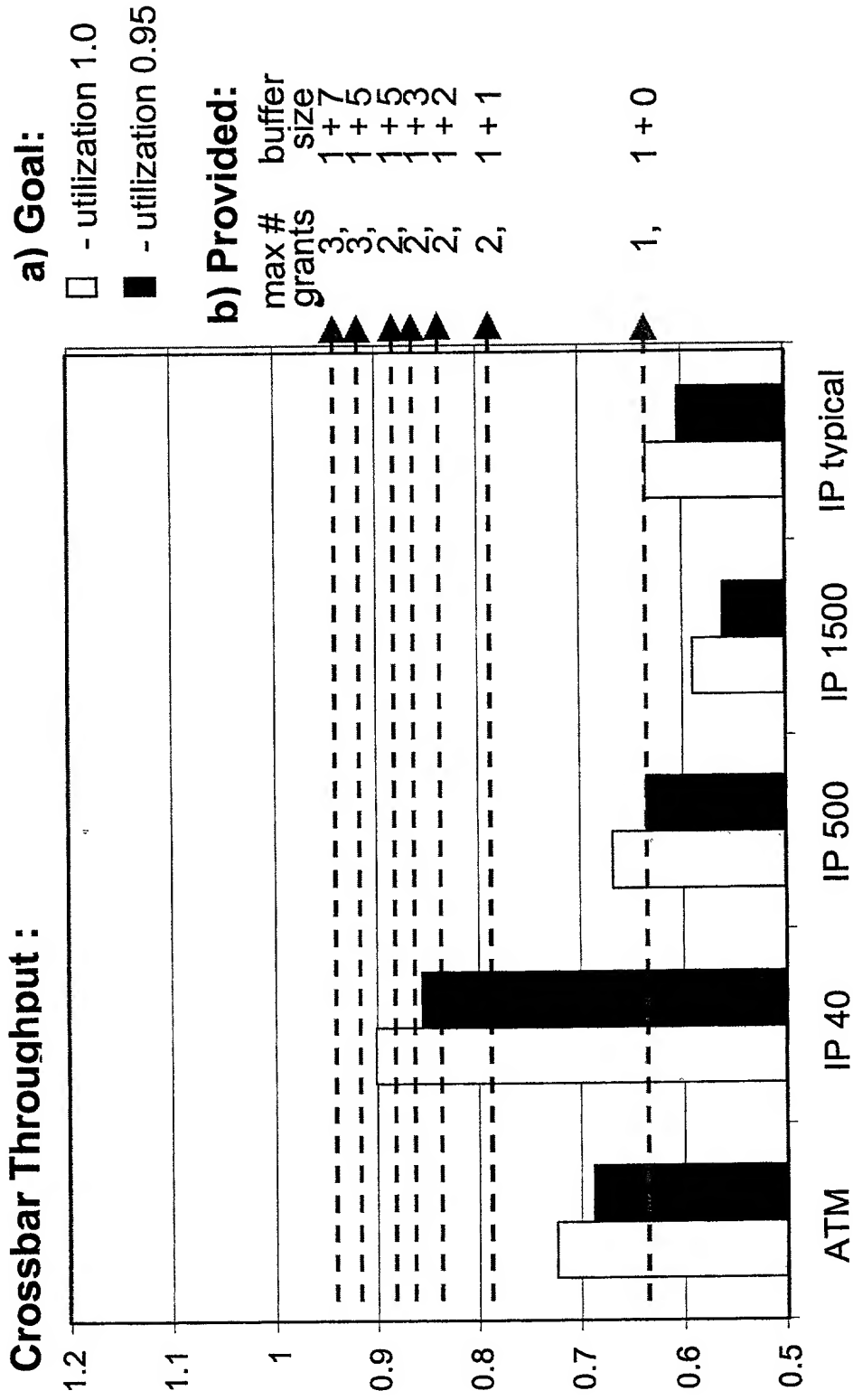
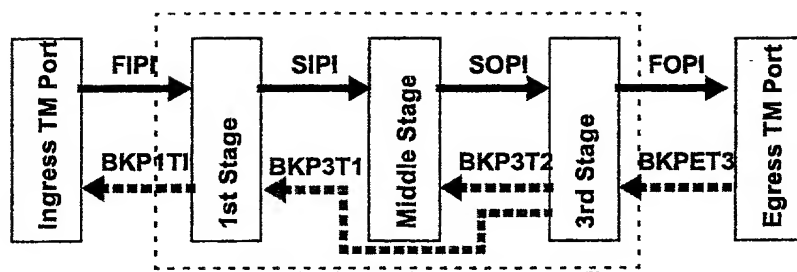
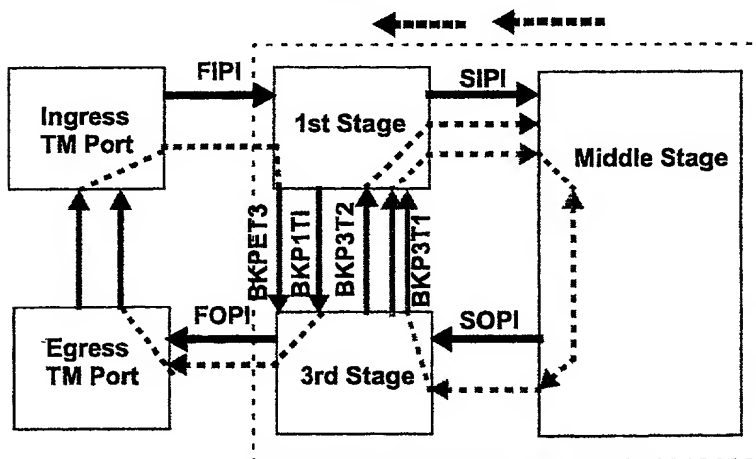


FIG. 27



A: The Logic Backpressure Flow



B: The Actual Backpressure Flow

FIG. 28

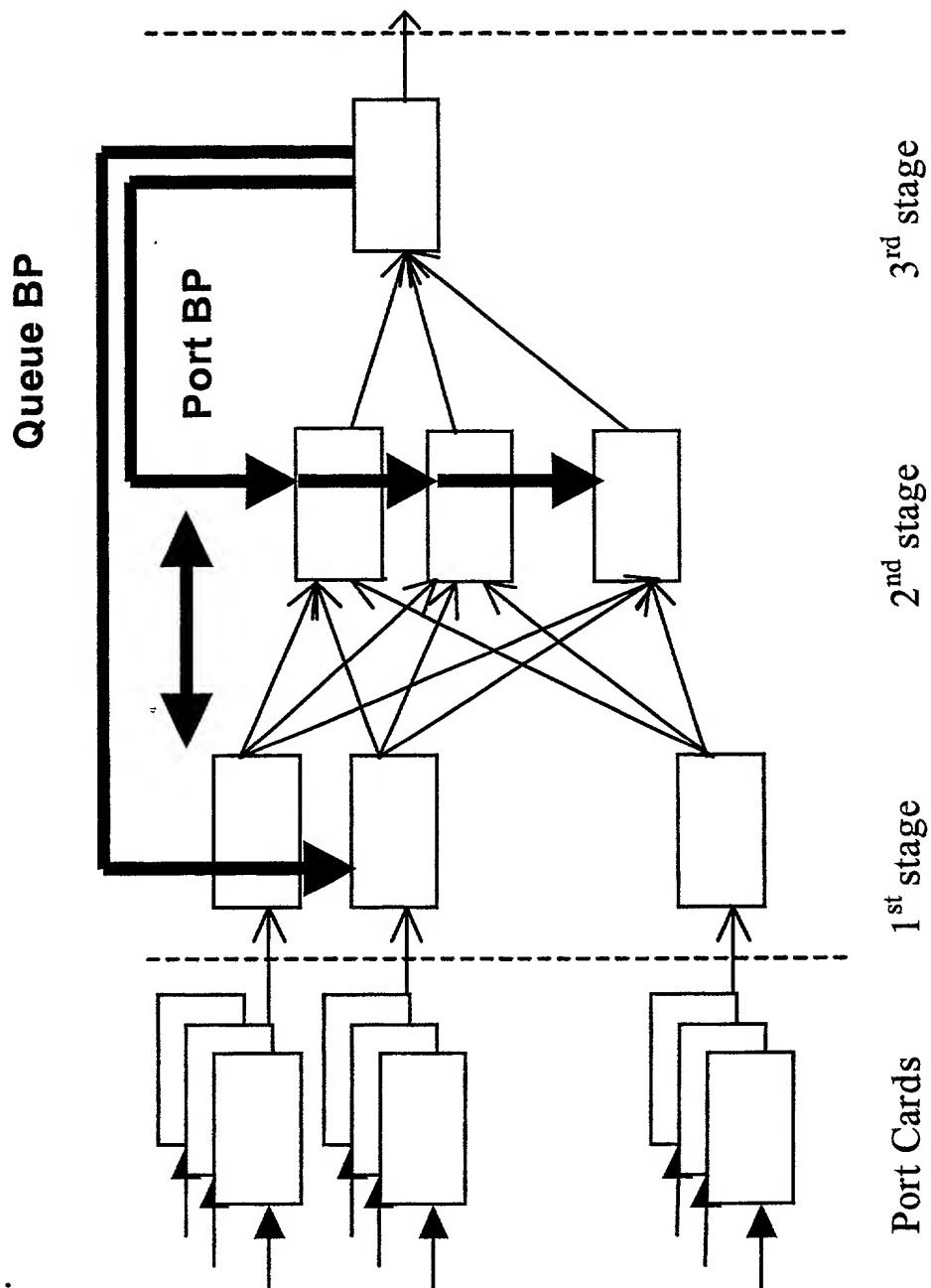


FIG. 29

